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A COMPREHENSIVE PROGRAM FOR WATER POLLUTION CONTROL FOR THE CENTRAL COLUMBIA RIVER BASIN

Washington Pollution Control Commission
Olympia, Washington

1954

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A COMPREHENSIVE PROGRAM FOR WATER POLLUTION CONTROL for the CENTRAL COLUMBIA RIVER BASIN

U. S. DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE

Public Health Service

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A COMPREHENSIVE WATER POLLUTION CONTROL PROGRAM

for the

CENTRAL COLUMBIA RIVER BASIN

Developed by the Washington Pollution Control Commission

in cooperation with the

Washington State Department of Health

Adopted by

U. S. DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE
Public Health Service

1954

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FOREWORD

Our country's development over the past 50 years has been marked by tremendous progress in many fields. It has made possible great gains in the health, comfort, and well-being of the people. But it has not been without cost. Part of the cost has been the damage to the Nation's water resources that has resulted from wastes discharged to the streams by our growing cities and industries. All water uses have been affected--public water supplies, recreation, agriculture, industry, fish and aquatic life.

In enacting the Federal Water Pollution Control Act in 1948, the Congress declared that "water pollution has become a matter of grave concern in many areas and its damaging effects on the public health and national resources are a matter of definite Federal concern as a menace to national welfare. Abatement must be undertaken in order to control it."

The Public Health Service, as part of its responsibilities under this Act, is required to prepare or adopt, in cooperation with other Federal agencies, State and Interstate water pollution control agencies, and municipalities and industries, comprehensive programs for the abatement of pollution.

This publication summarizes "A COMPREHENSIVE POLLUTION CONTROL PROGRAM FOR THE CENTRAL COLUMBIA AND COLUMBIA BASIN RECLAMATION AREA," developed by the Washington State Pollution Control Commission. This Commission is the official Washington State agency which has legal authority to adopt and enforce measures for the abatement, prevention and control of pollution of the waters of the State (Chapter 216, Laws of 1945, as amended, State of Washington). The program is sound and gives full consideration to the several present uses and to the reasonably anticipated future uses of the waters of the Central Columbia River Basin. It provides an equitable balance in the pollution control requirements for the various private and public groups concerned, and through full cooperation of the Washington State Health Department can assure that proper emphasis will be placed on public health aspects of the program.

I am pleased, therefore, in my capacity as Surgeon General of the Public Health Service, to adopt the program developed by the State of Washington for the Central Columbia River Basin, as a comprehensive program which fully meets the requirements of the Federal Water Pollution Control Act.

This program is based on beneficial water uses and related conditions that prevailed on January 1, 1954. Comprehensive programs for pollution control must necessarily be flexible. They must allow for growth, development, and changing conditions. Any significant changes affecting water quality, such as changes in stream flow, water use, industrial development or population may require changes in the pollution control program.

Obviously the mere adoption of this program will not, in itself, reduce pollution or improve the usefulness of the waters in the Central Columbia River Basin. It does provide to the citizens of the area and to the city officials and industrial leaders, farmers, fishermen, conservationists, and others an objective plan based on good engineering practice, and reflecting sound economics. It is a plan which the public can support and must support if progress is to be made in the abatement of pollution.

Certain additional considerations beyond the mere acceptance of a plan are essential to its successful execution. The citizens of the areas affected must see that sufficient resources are provided to the State water pollution control agencies concerned to enable them to make the technical investigations necessary to aid those responsible for constructing pollution abatement works.

We must recognize, too, that in order to be fully effective the plans and programs of one State must be geared closely to those of adjoining States, since State boundaries are no barrier to pollution traveling in interstate streams. Above all, no program of this nature can progress beyond the report stage if its meaning and purpose are not made clear and understandable to the

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citizens of the area. In the final analysis they are the ones who will pay, directly or indirectly, for the pollution abatement works that are needed.

It is my hope that this program for the Central Columbia River Basin will be carried through to completion so that the area may enjoy all the benefits that clean water can provide, in health and recreational opportunities for the people and in sound growth of industry and agriculture.

Leonard A. Scheele

Leonard A. Scheele
Surgeon General

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CENTRAL COLUMBIA
AND
COLUMBIA BASIN RECLAMATION AREA
LOCATION MAP

LEGEND

- CANAL
- TUNNEL
- SIPHON
- (450) RIVER MILE

CENTRAL COLUMBIA RIVER BASIN
GENERAL REFERENCE MAP

U.S. DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE
Public Health Service
DIVISION OF WATER POLLUTION CONTROL
MAP NO. 1

CENTRAL COLUMBIA RIVER BASIN

DISCUSSION

General

This document describes briefly the comprehensive water pollution control program developed by the Washington Pollution Control Commission with the cooperation and assistance of the Washington State Department of Health for the "Central Columbia and Columbia Basin Reclamation Area." The program is given in detail in the Pollution Control Commission's report entitled, "A Comprehensive Pollution Control Program for the Central Columbia and Columbia Basin Reclamation Area," published in September 1952.

The area embraced by the program of the Washington Pollution Control Commission has been designated for convenience as the "Central Columbia River Basin." The Central Columbia River Basin, as referred to in this document, includes the Columbia Basin Reclamation Area and, in addition, two adjacent areas which are closely related to the Reclamation Area in topography and economy. These adjacent areas consist of: (1) land lying to the westward and northward of the Reclamation Area on both sides of the Columbia River which drains to the Columbia River below Grand Coulee Dam, and (2) land lying to the eastward of the Reclamation Area which drains into the Reclamation Area. The extent of the Central Columbia River Basin and the relation of the Columbia Basin Reclamation Area to the entire area are indicated on Map No. 1.

This area comprises a substantial part of the "Columbia River Basin above the Yakima River," which is one of the major sub-basins into which the Columbia River Basin has previously been divided as convenient bases for preparation of comprehensive water pollution control programs. Subsequently a comprehensive program will be developed for the entire Columbia River Basin above the Yakima River, which will include the comprehensive water pollution control program herein described.

Prior to the development of the comprehensive program, and at the request of interested citizens, a meeting was held in the basin under the leadership of the Quincy Chamber of Commerce for the purpose of discussing the water pollution problem. This meeting was attended by mayors, officials, and interested citizens from the cities in the basin, as well as representatives of industry, the Columbia Basin Irrigation Project, the Washington Pollution Control Commission, and the Washington State Health Department. Following this meeting and at the request of the group, studies and investigations were made by the Pollution Control Commission of sources and magnitudes of polluting wastes discharged into the Columbia River and its tributaries in the basin and the effects of these wastes upon the quality of the receiving waters. The comprehensive program for the basin was developed after completion of these studies. At a later date, under the chairmanship of the Quincy Chamber of Commerce, the Director of the Pollution Control Commission met with the group and outlined the comprehensive program to them. At a third meeting, officers were elected by the group and a work group was named to cooperate with the Pollution Control Commission in carrying forward these pollution control activities.

The Columbia Basin Irrigation Project under development by the Bureau of Reclamation, Department of the Interior, will eventually provide irrigation for about one million acres of land located in the Columbia Basin Reclamation Area. Water for this irrigation project is being pumped from Lake Roosevelt, the impoundment of Columbia River water formed by Grand Coulee Dam.

The availability of irrigation water to this vast semi-arid area included in the Columbia Basin Reclamation Area will, of course, greatly change its economy. For this reason, the region is expected to be the most rapidly developing area in the State of Washington during the next decade. As this development will be attended by problems of waste disposal, the adoption and carrying out of this comprehensive water pollution control program as the area develops will assure maximum protection to the water resources of the area.

Physical Description

The Central Columbia River Basin is located in the northern section of the Columbia Plateau in eastern Washington between spurs of the Rocky Mountains on the east and the Cascades on the west. This basin is approximately 150 miles long, north and south, and 120 miles wide, east and west.

The Columbia River itself, except in the southern part of the Central Columbia River Basin, flows in a canyon varying from 300 feet to 2,000 feet in depth, forming a dividing line between the plateau areas to the eastward and the mountain areas to the westward.

The Central Columbia River Basin is comprised chiefly of the area to the eastward of the Columbia River which is enclosed in the Big Bend of the Columbia. In general, this area is bounded on the north and west by approximately 310 miles of the main stem of the Columbia River from its confluence with the Snake River in the south to its confluence with the Spokane River in the north, and on the east and south by the ridges which separate the Columbia River Basin from the Spokane and Snake Basins. The Central Columbia River Basin includes also a narrow strip of land along the west bank of the Columbia River which extends from the mouth of the Snake River upstream to Grand Coulee Dam. However, the basins of the principal streams which drain into this reach of the Columbia from the west, including the Okanogan, Methow, Chelan, Entiat, and Wenatchee Rivers, are not included in this document. They were omitted because of the great differences in the physical characteristics and economies of these basins as compared to the Central Columbia River Basin.

That portion of the Columbia River Basin to the east of the Columbia River is a broadly rolling semi-arid plateau which drains to the Columbia River, in general from the north and east. This plateau area varies in elevation from about 500 feet above sea level in the south to about 1,500 feet in the northern part of the basin. Crab Creek, the only stream of significance in the plateau, has a drainage area of about 5,000 square miles. Upper Crab Creek heads near Reardan and disappears into the ground a few miles southeast of the Town of Soap Lake. Flows are intermittent through a large portion of the remainder of the upper drainage area. Lower Crab Creek has its source in Moses Lake. Some sections lack surface flow during periods of dry weather. There are numerous small creeks and coulees in the plateau area which carry water only intermittently and for short periods of time. A number of lakes are formed by the water standing in the pools of these intermittent watercourses. Some lakes, such as Soap Lake and Medical Lake, have no outlets and are highly mineralized. The narrow strip of the Central Columbia River Basin to the west of the Columbia River includes mountains, mountain valleys and plateaus, and drains directly to the Columbia River.

Hydrology

The annual precipitation over the Central Columbia River Basin varies from about 6 inches in the lower southwestern part to about 10 inches in the northeastern uplands, with an average of 7.75 inches at Ephrata in the heart of the area. Most of the rainfall occurs in the winter and spring months. Winter snowfall averages from 12 to 15 inches annually.

The watercourses from that area of the Central Columbia River Basin lying to the eastward of the Columbia River originate in this semi-arid plateau area and have little flow during the summer and fall months or are intermittent in character. Because of the low precipitation, relatively little runoff from this area reaches the Columbia River. The major tributaries draining through the narrow strip of land along the west banks, being snow-fed, contribute substantially larger quantities of runoff to the Columbia River, but their basins are not included in the scope of this comprehensive program.

The flow in the main stem of the Columbia River through the Central Columbia River Basin is very large, but subject to considerable variation. The Columbia is fed by numerous snow-fed tributaries and is characterized by large summer flows. Peak flows usually occur during June or July, and high discharges are maintained throughout the summer and early fall. Minimum annual flows occur during the winter months. During the period of record, 1911 to 1950 inclusive, at Trinidad, Washington, near the midpoint of this reach of the Columbia, the average recorded flow was 110,000 second-feet. The maximum recorded daily flow during this period was 692,000 second-feet, while the minimum daily flow was 20,000 second-feet. The average daily flow during the minimum month of record was 80,400 second-feet, and occurred in February 1937. Extreme minimum flows of fractional day duration as low as 4,100 second-feet have occurred as a result of regulation by Rock Island Dam, 12 miles upstream from Trinidad.

Extreme maximum and minimum flows of the Columbia River through the Central Columbia River Basin are partially regulated through control of the outlet gates at Grand Coulee Dam and use of the storage in Franklin D. Roosevelt Lake. This Lake, impounded by Grand Coulee Dam,

has an active storage capacity of 5,072,000 acre-feet and is the source of water supply for the Columbia Basin Irrigation Project. Water for irrigation is pumped from the lake into an equalizing reservoir, having a usable storage capacity of 700,000 acre-feet. This reservoir was formed by blocking the inlet and outlet ends of an ancient channel of the Columbia River, known as Grand Coulee. From the equalizing reservoir, over 5,000,000 acre-feet of water per year will eventually be distributed through the Irrigation Project Area by means of a system of canals and pumping stations. The quantity of water diverted for irrigation purposes from the Columbia River and tributaries above the Central Columbia River Basin, however, is negligible in proportion to the total Columbia River flow.

Smaller reservoirs in the Kootenai, Pend Oreille, Spokane, Okanogan and Chelan River Basins are also used in regulating flows of the Columbia River. Further regulation will be provided by Libby Reservoir on Kootenai River and Priest Rapids Dam on Columbia River, both of which are authorized for construction, and to a minor extent by the power pool impounded by Chief Joseph Dam now under construction on Columbia River near Bridgeport and others not considered pertinent to this document.

The character of Upper and Lower Crab Creek, and of many of the intermittent creeks and coulees tributary to the Columbia River, is expected to change as a result of the Columbia River Irrigation Project. Some of these small tributaries may flow continuously as a result of the return irrigation water which will find its way into them.

Water Uses

Water provides the basis of almost the entire economy of the Central Columbia River Basin. There are three general sources of water in the basin: natural watercourses, ground water, and water from irrigation canals and ditches. The main stem of the Columbia River is the major source of surface water supply, although there are many lakes which also provide sources. The chief uses of water in the basin are for generation of hydroelectric power and for irrigation; other important uses are for domestic and industrial water supply, livestock watering, wildlife refuges, fisheries, recreation, and maintenance of downstream navigation.

Grand Coulee Dam and power plant, located in the northern part of the Central Columbia River Basin, with a generating capacity of 1,944,000 kilowatts, is the Nation's largest power plant. Downstream, the Chief Joseph Dam and power plant, now under construction at Bridgeport, will have capacity for producing 1,024,000 kilowatts of power. About 10 miles below Wenatchee is the Rock Island Dam and power plant, with a capacity of 210,000 kilowatts. In addition to these dams now existing or under construction, the Priest Rapids Dam and power plant is proposed for construction at Priest Rapids downstream from the Rock Island Dam, and is to have a generating capacity of 1,219,000 kilowatts. Thus, with a present potential capacity for producing over 4,000,000 kilowatts, and an estimated total capacity of 7,440,000 kilowatts, Central Columbia River Basin is expected to be one of the leading power-producing areas of the world.

In addition to making possible the pumping of tremendous quantities of water for irrigation purposes, the existing power has already attracted to the basin and the surrounding area the Hanford Works of the Atomic Energy Commission and several aluminum and magnesium plants, all of which produce critical materials. Other smaller industries have likewise been attracted and it is expected that new industries will continue to come into the region. Then, too, power produced by these hydroelectric plants, because of its use for domestic and general purposes in both rural and urban areas, is now and will continue to be a great boon to the economic life of the entire region.

Next to hydroelectric power development in importance, and having an even greater effect on the economy of the Central Columbia River Basin, is the use of water for irrigation. Because of the fact that the Columbia is characterized by a large volume of flow, with sustained high flows during the summer months, the period of maximum need, this river is ideally suited as a source of irrigation water. By far the largest irrigation project in the basin is the Columbia Basin Irrigation Project, which makes use of Columbia River water. There are also other areas under irrigation in the basin, located chiefly along the main stem of the Columbia River.

The lands to be irrigated by the Columbia Basin Irrigation Project cover an area of about 3,900 square miles, located in the southern part of the basin, extending from Ephrata to Pasco, about 80 miles, north and south, and about 60 miles to the eastward from the Big Bend of the Columbia River. Under the current schedule, about 413,000 acres of this area will be irrigated by 1959, and 1,029,000 acres will be irrigated ultimately. The land is very productive and adapted to the raising of a variety of farm crops. Water requirements, under full development, are anticipated at the net rate of about four acre-feet per acre of irrigated land per year, amounting to approximately 2,000,000 acre-feet of water annually for the currently scheduled initial development and about 4,300,000 acre-feet per year ultimately. Some idea of the economic value of this irrigation project to the region can be gained from experiences in other irrigated areas in the State. Although the value of irrigated crops raised in those areas is quite variable, a reasonable average annual value of $125 per acre can be assumed. Using this figure, it is estimated that the annual value of crops from the currently scheduled project will be $56,000,000, and from the ultimate development will be over $125,000,000.

Most domestic water supplies of the Central Columbia River Basin are obtained from deep drilled wells and serve incorporated cities and towns, unincorporated communities, industries, and farms. A few communities obtain their public water supplies from surface water sources. Many industrial plants secure water from community water supplies, while a few have their own deep wells. At present the ground water of the basin is free of contamination and constitutes a suitable source of both domestic and industrial supplies.

The Columbia River is the only substantial source of surface water supply in the basin. Except for certain sections of Crab Creek and several of the larger springs, the watercourses of the basin are not capable of providing a dependable source of water supply. Those lakes which are not mineralized are generally considered as satisfactory sources for water supplies having limited demands, if properly treated. Although future return flows from irrigation will greatly increase the available surface water in the basin, the chemical quality of the return flows may limit their usefulness for some purposes. Heavy algal blooms, stimulated by nutrients in the return flows, will also tend to discourage use of the water for many purposes. Further, a considerable acreage of sloping agricultural land is to be irrigated as part of the project. Unless proper irrigation practices are employed, greatly increased erosion with resultant increases in turbidity may be expected from these areas.

Communities obtaining their water supplies from deep drilled wells are: Almira, Brewster, Bridgeport, Connell, Creston, Davenport, East Wenatchee, Electric City, Ephrata, Harrington, Lind, Mansfield, Medical Lake, Moses Lake, Nespelem, Odessa, Othello, Quincy, Reardan, Ritzville, Rock Island, Soap Lake, Warden, Waterville, and Wilson Creek. In addition, Coulee City secures water from an artesian spring and Wilbur has an auxiliary shallow well supply.

Coulee Dam secures water from Lake Roosevelt and other surface sources; Grand Coulee from Lake Roosevelt; Brewster partially from a surface source; Kennewick from an infiltration gallery on the Columbia River, supplemented by a well; Pasco and Wenatchee from the Columbia River. The latter two communities treat the river water by coagulation, rapid sand filtration, and disinfection.

There is now some use of the waters of the Central Columbia River Basin for the watering of livestock. This use will become much more important along with the expected increase in livestock raising as the Columbia Basin Irrigation Project develops.

The Columbia Basin Reclamation Area is an important waterfowl hunting area, since it is located along a major migration route of the Pacific Flyway. There is also some hunting of upland game birds. Then, too, the Columbia River, Lower Crab Creek, and the various lakes, except the most highly mineralized lakes, provide good waters for sport fishing. The most important kinds of fish are steelhead and rainbow trout, mountain whitefish, small-mouth and large-mouth black bass. The Fish and Wildlife Service has estimated that the Columbia Basin Project will increase the annual value of wildlife in the area by more than nine times. They have also estimated that, exclusive of Lake Roosevelt, the Project would nearly double annual fisheries values.

There are now several wildlife preserves in the basin, including the Lenore Lake National Wildlife Refuge and Stratford State Game Reserve. The State Game Department is developing a trout fishery in the Sun Lakes group and a bass-fishing area in the Equalizing Reservoir.

This Department, which is responsible for the rearing of game and fish and supervision of hunting and fishing activities, plans to develop more wildlife preserves and fisheries. Trout fisheries are planned for Goose and Black Lakes and bass fisheries for Long Lake, Moses Lake, Potholes Reservoir, Scooteney Lake and Scooteney Reservoir. Areas for which wildlife preserves are planned include Long Lake, Columbia Wasteway and Winchester Wasteway.

The main stem of the Columbia River supports migrations of anadromous fish, including steelhead trout and blueback, chinook and silver salmon. The construction of Grand Coulee Dam stopped such migrations into the Upper Columbia River and tributaries, but new runs of these fish have been established in the tributaries below the dam to replace those lost above Grand Coulee Dam.

Recreational boating, swimming and picnicking activities in the Central Columbia River Basin have in the past been confined largely to certain portions of the Columbia River and to Soap Lake and other lakes in the area below Dry Falls. There are at present several State parks in the basin with general recreational facilities, including the Dry Falls, Sun Lakes, and Moses Lake State parks. Many new recreational areas will be created, however, with the development of the Columbia Basin Irrigation Project and the corresponding increased demand for recreational facilities. Water recreation is favored because of the high summer temperatures. Thus, use of the waters of the basin for recreation will become increasingly important.

The State Parks and Recreation Commission, in cooperation with the Federal agencies involved, has plans for the development of boating, swimming, picnicking and similar types of recreational facilities, centered chiefly around Potholes Reservoir, Equalizing Reservoir, Moses Lake, and Long Lake. The plans of the State Parks and Recreation Commission contemplate the development of two new State Park areas of Long Lake, and the enlargement of two existing State Parks, the Sun Lakes and Moses Lake State Parks.

The control of the Columbia River water impounded in the basin facilitates the maintenance of downstream navigation. Commercial navigation at present does not extend above Pasco and Kennewick, approximately 4 miles above the mouth of the Snake River, but provision has been made for a future lock in the authorized Priest Rapids Dam, should navigation to Wenatchee become justifiable.

Sources of Pollution

There are 44 municipalities[1/] in the Central Columbia River Basin with a total 1952 estimated population of 105,000[2/]. Thirty of these municipalities, with a population of 94,800[2/], have sewers which serve approximately 84,300[2/]. Table 1 summarizes the waste disposal facilities for these 30 municipalities.

1/ "Municipalities," as used herein, includes incorporated and unincorporated municipalities, institutions, military establishments, and other population centers.

2/ These population figures do not include the populations of the two military establishments.

TABLE 1

SUMMARY OF MUNICIPAL WASTE DISPOSAL FACILITIES

Type of Treatment	No. of Municipalities	Population Served	No. of Treatment Plants with Adequate Capacity	No. Treatment Plants of Adequate Capacity Needing Improved Operation
Secondary	8	32,400	8	3
Primary - Sub-surface Land Disp.	8	8,800[2]	4	0
Primary	11*	28,300	6*	1
None	3	14,800	-	-
Total	30	84,300	18	4

* Includes one plant under construction.

Fourteen municipalities in the basin at present do not have any community sewer systems or sewage treatment facilities. These 14 municipalities are: Appleyard, Creston, Electric City, Elmer City, Hartline, Hatton, Marlin (formerly known as Krupp), Medical Lake, Nespelem, Odessa, Pateros, Warden, Wilson Creek, and West Wenatchee. Only five of these communities, however, have estimated populations in excess of 750, as follows: West Wenatchee (unincorporated), 2,690; Appleyard (unincorporated), 1,479; Odessa, 1,127; Pateros, 866; and Electric City, 799. Some residences, business places, and industries in these municipalities have adequate private waste disposal facilities, while others do not have adequate facilities and are discharging wastes to watercourses.

There were 45 industrial plants in operation in the basin as of January 1, 1954, and an additional plant under construction. A considerable increase in the number of industrial plants is anticipated as the area develops. Fifteen of these plants are connected to municipal sewer systems; the other 30 either discharge their wastes through a separate outlet or have no wastes of pollutional significance.

The fifteen plants connected to municipal systems increase the population equivalent of the raw wastes before treatment from 84,300[3] to 87,300[4]. After treatment in 27 municipal sewage treatment plants, the population equivalent of these wastes is reduced to 49,300[4] before they are discharged into various nearby watercourses.

Of the industrial plants having separate outlets, 7 produce no wastes of consequence. Six plants produce only inorganic wastes and, although all of these plants have provided some type of treatment, two of the treatment works need improved operation and a third needs to expand and improve its treatment facilities.

[2] These population figures do not include the populations of the two military establishments.

[3] Does not include population of two military establishments.

[4] Does not include population of two military establishments or wastes from large canning plant having a population equivalent of 50,000.

Nine of the 17 industrial plants producing significant quantities of organic wastes utilize some type of land disposal--either lagoons, oxidation ponds, or subsurface disposal systems. Seven of the 9 are indicated as having no needs; one should provide additional facilities and improved operation, and the other needs only adequate operation and maintenance. Six of the remaining 8 industrial plants have some type of treatment other than land disposal. However, 5 of the 6 treatment plants are inadequate and need additional facilities, the sixth having no needs at present. One of the 2 plants having no waste treatment facilities should secure a connection to the municipal sewage system. The other plant needs new waste treatment facilities.

Table 2 summarizes by type the significant sources of pollution presently existing in the basin and indicates needed pollution abatement action. Map No. 2 shows the distribution of sources of wastes in the basin and needed facilities.

TABLE 2

SUMMARY OF POLLUTION ABATEMENT NEEDS

Type of Source	No. of Sources	Existing Treatment	Waste Treatment Needs	P.E. Discharged to Stream
Municipality	9	Yes	Additions	3,375[2]/
Municipality	4	Yes	Improved Operations	750
Municipality	3	No	New plants	16,775[3]/
Industry	4	Connect to City Sewer	Improvements	--- [4]/
Industry	6[1]/	Yes	Additions	2,480
Industry	2	Under Construction	None	2,500
Industry	2	Yes	Improved Operation	0[5]/
Industry	1	No	New Facilities	230
Totals	31			28,110

1/ Includes 3 plants having waste treatment facilities which need improved operation.

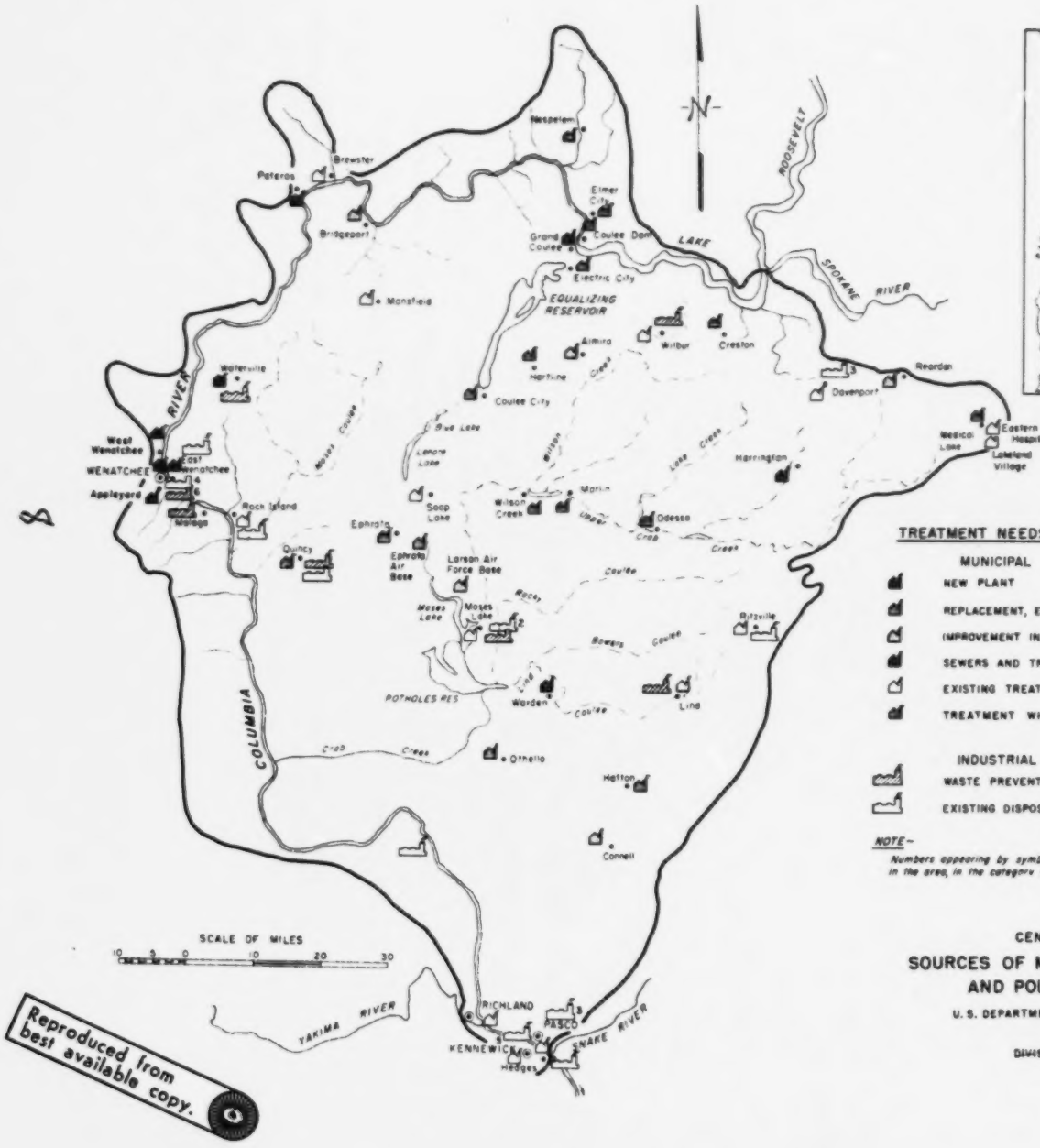
2/ Does not include populations of two military installations.

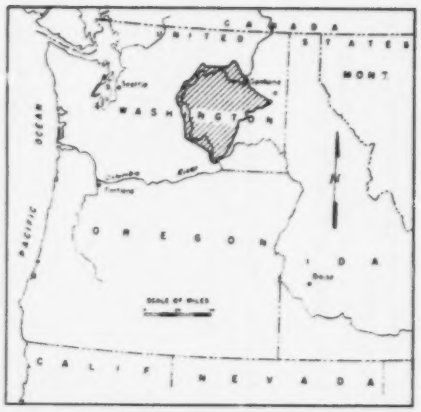
3/ Does not include wastes from large canning plant having peak P.E. of 50,000.

4/ Included elsewhere in document with industrial wastes discharged to municipal sewers.

5/ One plant has inorganic wastes. The other uses subsurface land disposal.

In addition to the requirements indicated in Table 2, all industrial plants should comply with the "Minimum Requirements for the Prevention of Industrial Waste Pollution" as adopted by the Washington Pollution Control Commission.





CENTRAL COLUMBIA
AND
COLUMBIA BASIN RECLAMATION AREA
LOCATION MAP

TREATMENT NEEDS

MUNICIPAL

- NEW PLANT
- REPLACEMENT, ENLARGEMENT, OR ADDITIONS
- IMPROVEMENT IN OPERATION
- SEWERS AND TREATMENT PLANT
- EXISTING TREATMENT ADEQUATE
- TREATMENT WHEN SEWERS ARE BUILT

INDUSTRIAL

- WASTE PREVENTION, TREATMENT, OR OTHER SATISFACTORY DISPOSAL FACILITIES
- EXISTING DISPOSAL FACILITIES ADEQUATE

NOTE-
Numbers appearing by symbols indicate total number of industrial sources of pollution in the area, in the category designated

CENTRAL COLUMBIA RIVER BASIN

SOURCES OF MUNICIPAL AND INDUSTRIAL WASTES AND POLLUTION ABATEMENT NEEDS

U. S. DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE
Public Health Service
DIVISION OF WATER POLLUTION CONTROL
MAP NO. 2

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Damage to Water Resources

In the past, with the exception of the main stem of the Columbia River, there has been a very limited amount of surface water in the basin. This will change with the formation of the Equalizing Reservoir, Potholes Reservoir, and numerous other lakes and streams which may be formed as a result of irrigation.

Ground water levels in the area of the Columbia Basin Irrigation Project are presently comparatively far below the surface. During the first few years of irrigation, however, most of the water not lost by evaporation will be stored in the subsurface strata. Eventually the water level will probably rise to the elevation of the larger drainage ditches. The elevation of these ditches will largely determine the ground water levels. A point of equilibrium will eventually be reached at which the return water will be equal to that applied, minus that lost by evaporation and transpiration. At such time, the surface run-off will probably account for a significant portion of the return water. In certain locations, the top soil may become water-logged, and swampy areas will result. In other areas, the water level may be at a considerable depth. Small seasonal dropping of ground water levels will probably occur as a result of the fact that the irrigation ditches will be dry during the winter months.

Three inter-related factors are expected to have an important bearing upon water pollution control in the Central Columbia River Basin and must be considered in connection with a comprehensive water pollution control program. These factors are: (1) the underlying geological formation and the character of the soil in the basin; (2) the expected effect upon existing ground water levels of the extensive irrigation being developed under the Columbia Basin Irrigation Project; and (3) land disposal of sewage and industrial wastes made necessary by the lack of surface streams, a method now in common use in the basin.

The plateau areas of the basin are largely underlain by successive layers of basalt lava, each of which usually has a shattered zone at its base. The basalt layers are of varying thickness and are deformed by folds which have caused the formation of several subsurface basins. Between successive layers of basalt are discontinuous pervious layers of unconsolidated material, such as gravel and sand. The soil cover consists of varying thicknesses of clay, silt, sand, and gravel. The surface of the soil has been eroded by water and wind. These natural factors of surface and subsurface soil character and topography determine the rate at which irrigation water will percolate into the soil and the proportion of this water which will enter the water table. The porosity of the soil will determine how much of the water will be stored as the water table rises and how much will return to the Columbia River either as surface run-off or as return flow in the drainage ditches and natural watercourses.

Land disposal, both surface and subsurface, has in the past provided a satisfactory method of final disposal of sewage effluents without causing pollution of the ground water. It is quite possible, however, that the combination of the above-mentioned factors may adversely affect the quality of some shallow ground waters from which well supplies are drawn, as well as the quality of the irrigation water in the ditches and the return flows in the drains.

The exact pattern and scope of the changes which will occur as a result of the above-mentioned combination of factors cannot be foretold because of the variability and complexity of these factors. Consequently, no certain analysis of the resulting problems can be made at this time, nor can their exact effect upon the basin's water resources be determined. Each problem will require individual study. The sewage and waste disposal problems must be given at least equal consideration with other factors in the planning of the development of communities and industries. The degree of treatment must be adapted to suit the local conditions of disposal.

In many areas of the basin where geological and topographical conditions favor subsurface disposal of wastes, ground water is the only satisfactory source from which domestic and industrial requirements can be supplied. Extensive use of subsurface methods of waste disposal in such areas may adversely affect the quality of ground waters and could conceivably limit or prevent further development.

Water Quality Objectives

Waste reduction and treatment provides for the Central Columbia River Basin the most economical and desirable means of eliminating existing pollution and of preserving the generally high quality of its waters, upon which the economy of the basin is so largely dependent. The Washington Pollution Control Commission has, therefore, in conjunction with the other States in the Columbia River Basin, developed water quality objectives for the principal uses of the waters of the Columbia River Basin. These objectives indicate the minimum treatment requirements for domestic sewage and the quality of water which should be maintained in order that the waters may be used for: (1) drinking, culinary, and food processing purposes; (2) bathing, swimming, and recreation; (3) growth and propagation of fish and other aquatic life; and (4) agriculture and industrial water supply. The water quality objectives developed by the States of the Columbia River Basin are included in Appendix I.

Benefits and Costs

The carrying out of the comprehensive water pollution control program for the Central Columbia River Basin will bring many benefits to the health and welfare of the people, to agriculture, and to industry, and will facilitate further expansion of the economy of the basin.

The people will receive the benefits of improved quality of water supplies, increased freedom from the dangers of waterborne diseases, cleaner recreational and bathing water, increased property values, and the pleasure of living in a clean, progressive region. Benefits to agriculture will include improvement of water quality, which will make it more suitable for irrigation of leafy vegetable crops and safer as a source of rural domestic water supply. Industry will benefit through by-product recovery, increased availability of water supplies for future expansion, fewer damage suits and lower legal expenses, and through improved public relations. These benefits will help to assure a continuation of the healthy economic growth of the Central Columbia Basin.

The construction costs of the various facilities needed to carry out the comprehensive program for abatement of municipal pollution in the basin are estimated to be approximately $2,400,000. This figure is based on average per capita costs for a number of projects of comparable size constructed in the Pacific Northwest during 1952 and early 1953 and is presented to give some idea of the magnitude of needed facilities. An individual project may vary widely from the average figures used. Further, this figure is used to portray only current needs. The rapid growth of the area may double or triple the cost of pollution abatement works needed during the next 10 to 25 years.

The cost of facilities which will be required to abate the industrial pollution cannot be estimated until the possibilities of by-product recovery and waste reduction through process changes have been evaluated and the degree of treatment required has been determined by the Commission. However, the requirements of the Pollution Control Commission are reasonable and the cost should not be excessive.

COMPREHENSIVE PROGRAM

The present water pollution abatement needs in the Central Columbia River Basin are known and are tabulated at the end of this section of the document. However, it is not possible to predict in detail at this time the future needs for pollution abatement in the basin. The water quality objectives referred to in a previous section of this document have been developed as a guide to the solution of pollution problems which may logically be expected to occur as the economy of the basin progresses. Since these pollution problems will differ widely and since many of them cannot be foreseen at this time, the comprehensive program of water pollution control must be flexible enough to provide for a wide variety of conditions.

In order to meet the water quality objectives set forth in the foregoing discussion, the Washington Pollution Control Commission has adopted the following comprehensive program of water pollution control for the Central Columbia River Basin. The program includes all sources of domestic sewage and wastes from industrial processes as well as other operations which may affect the quality of surface or underground waters.

1. Adequate sewage treatment facilities for all sewered municipalities, and adequate sewage treatment facilities at the time sewer systems are found necessary for communities presently unsewered. Adequate treatment facilities for domestic wastes discharged to surface waters should be secondary treatment with effective disinfection of effluents, except for wastes discharged directly to the Columbia River. In these cases a minimum of primary treatment with effective disinfection of effluents will be required.

2. The employment of waste prevention methods for all industries, and pre-treatment, where needed, for those industries discharging their wastes to municipal sewer systems. Adequate treatment of wastes from industries discharging directly, or indirectly, to watercourses.

Waste disposal should be considered as an important factor in the choice of locations for new industrial establishments. Waste prevention, treatment or disposal should be considered in the design of such establishments. In all cases, the Washington Pollution Control Commission should be consulted during the planning stage of any industry which will have a waste disposal problem. Specific "Minimum Requirements for the Prevention of Industrial Waste Pollution" have been adopted by the Washington Pollution Control Commission. These minimum requirements are given in Appendix II.

3. Protection of the basin from activities that destroy or damage the water resources. The State and Federal agricultural agencies have developed programs for farming and irrigation practices which, if followed, will greatly reduce erosion and soil losses to ditches and streams. This comprehensive water pollution control program encourages the adoption of these practices by all farmers, and recommends full cooperation with the agencies promulgating them.

A tabulation of specific municipal and industrial requirements included under the Washington Pollution Control Commission Comprehensive Program for water pollution control in the Central Columbia River Basin follows:

Municipal Requirements[1/]

Name	Type of Waste To Be Treated	Requirements
Almira	Domestic	Improved operation
Appleyard	"	Sewers and new treatment plant
Bridgeport	"	New sludge pump
Connell	"	Improved operation

Municipal Requirements[1]

Name	Type of Waste To Be Treated	Requirements
Coulee City	Domestic	Additional treatment (secondary treatment and chlorination)
Coulee Dam	"	Additional treatment (sludge disposal and chlorination)
Creston[2]	"	Sewers and new treatment plant
East Wenatchee	"	Sewers and new treatment plant
Electric City[2]	"	Sewers and new treatment plant
Elmer City[2]	"	Sewers and new treatment plant
Ephrata	"	Enlargement of existing plant and additional treatment (chlorination)
Ephrata Air Base	"	Additional treatment (chlorination)
Grand Coulee	"	New treatment plant
Harrington	"	New treatment plant
Hartline[2]	"	Sewers and new treatment plant
Hatton[2]	"	Sewers and new treatment plant
Lind	"	Secondary treatment
Marlin (or Krupp)[2]	"	Sewers and new treatment plant
Medical Lake[2]	"	Sewers and new treatment plant
Larson Air Force Base	"	Improved operation (chlorination)
Nespelem[2]	"	Sewers and new treatment plant
Odessa[2]	"	Sewers and new treatment plant
Pasco	Domestic and Industrial	New treatment plant (under construction)
Pateros	Domestic	Sewers and new treatment plant
Quincy	"	Enlargement of existing plant and additional treatment (chlorination)
Reardan	"	Improved operation
Warden	"	Sewers and new treatment plant
Waterville	Domestic and Industrial	New treatment plant
Wenatchee	Domestic and Industrial	New treatment plant

Municipal Requirements (Continued)

Name	Type of Waste To Be Treated	Requirements
West Wenatchee	Domestic	Sewers and new treatment plant
Wilson Creek 2/		Sewers and new treatment plant

1/ "Municipalities," as used herein, includes incorporated and unincorporated municipalities, institutions, military establishments, and other population centers.

2/ These communities have no municipal system. They are served by individual waste disposal systems, principally septic tanks followed by subsurface disposal. At such time as a community system is built, adequate waste treatment facilities should be included as part of the project.

Industrial Requirements

The following industries should provide facilities to comply with the "Minimum Requirements for Prevention of Industrial Waste Pollution" (see Appendix II), adopted by the Washington Pollution Control Commission, and/or in addition where needed should provide connections to municipal sewers or other facilities for treatment or disposal of liquid wastes, whichever is appropriate in each specific case:

Name	Location	Type of Industry
Allied Chemical Corporation	Hedges	Inorganic chemicals
Battermann's Quality Sand and Gravel	Wenatchee	Dredge mining
D. and D. Foods	Wenatchee	Canning
Lind Packing Co.	Lind	Meat packing
McInroy Meat Co.	Wilbur	Meat packing
Moses Lake Meat Co.	Moses Lake	Meat packing
Pacific Pulp Moulding Co.	Wenatchee	Paper products
Quincy Corporation	Quincy	Diatomaceous earth mining
Twin City Livestock & Poultry Co.	Kennewick	Meat packing
Wenatchee Packing Co.	Wenatchee	Meat packing
Wenatchee Rendering Works	Wenatchee	Rendering
Wenatchee Valley Foods	Wenatchee	Cannery

Appendix I

Water quality objectives and minimum treatment requirements (developed by the Washington Pollution Control Commission for the Yakima River Basin)

Water quality / Water uses	Water quality objectives, applicable to receiving waters, for salt and fresh surface waters and underground waters				
	Organisms of the coliform group	Floating, suspended and settleable solids and sludge deposits	Taste or odor producing substances	Dissolved oxygen	pH
A. Water supply, drinking, culinary, and food processing: without treatment other than simple disinfection and removal of naturally present impurities.	Most probable number coliform bacterial content of a representative number of samples should average less than 50 per 100 ml. in any month.	None attributable to sewage, industrial wastes or other wastes or which, after reasonable dilution & mixture with receiving waters interfere with the best use of these waters for the purpose indicated.	None attributable to sewage, industrial wastes, or other wastes.	Greater than five (5) parts per million except for underground waters.	Hydrogen ion concentration expressed as pH should be maintained between 6.5 & 8.5
B. Water supply, drinking, culinary, and food processing: With treatment equal to coagulation, sedimentation, filtration, disinfection and any additional treatment necessary for removing naturally present impurities.	M.P.N. coliform bacterial content of a representative number of samples should average less than 2,400 per 100 ml. and should not exceed this number in more than 20 percent of samples examined in any month when associated with domestic sewage.	Same as for use "A" above.	None attributable to sewage, industrial wastes, or other wastes which, after reasonable dilution & mixture, will increase the threshold odor number above eight (8).	Greater than five (5) parts per million except for underground waters.	Same as for use "A" above.
C. Bathing, swimming and recreation Note: When waters are used for recreational purposes such as fishing & boating, exclusive of bathing & swimming, the number "5000" may be substituted for "240" in statement of coliform objective.	M.P.N. coliform bacterial content of a representative number of samples should average less than 240 per 100 ml. and should not exceed this number in more than 20 percent of samples examined when associated with domestic sewage.*	Same as for use "A" above.	None attributable to sewage, industrial wastes, or other wastes which, after reasonable dilution & mixture, will interfere with the best use of these waters for the purpose indicated.	Greater than five (5) parts per million.	Same as for use "A" above.
D. Growth and propagation of fish, shellfish and other aquatic life	M.P.N. coliform bacterial content of a representative number of samples should not have a median concentration greater than 70 per 100 ml. in waters used for the growth & propagation of shellfish.	Same as for use "A" above.	None attributable to sewage, industrial wastes, or other wastes which will interfere with the marketability or propagation of recreational or commercial fish, shellfish, or other edible aquatic forms.	Greater than six (6) parts per million.	Same as for use "A" above.
E. Agricultural and industrial water supply: without treatment except for the removal of natural impurities to meet special quality requirements, other than those classified under "A" above. Note: Permissible limits for total concentration percent sodium, boron, chlorides, and sulphates to receive further study. Suggested value for percent sodium is less than 60, percent sodium means the ratio of sodium to total cations expressed in equivalent weights calculated from the formula $\%Na = 100 Na + K + Ca + Mg$ when Na, K, Ca, and Mg are all expressed in equivalents.		Same as for use "A" above.	None attributable to sewage, industrial wastes, or other wastes which will adversely affect the marketability of agricultural or industrial produce.	Greater than three (3) parts per million.	Hydrogen ion concentration expressed as pH should be maintained between 6.0 & 9.5

*See note under "C" above.

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Water quality objectives and minimum treatment requirements (developed by the Washington Pollution Control Commission for the Yakima River Basin)--Continued

Water quality / Water uses	Water quality objectives, applicable to receiving waters, for salt and fresh surface waters and underground waters				Minimum treatment requirements for domestic sewage
	Toxic, colored, or other deleterious substances	Phenolic compounds	Oil	High temperature wastes	
A. Water supply, drinking, culinary, and food processing: Without treatment other than simple disinfection and removal of naturally present impurities.	None alone or in combination with other substances or wastes in sufficient amounts or of such nature as to make receiving water unsafe or unsuitable for use indicated (U.S.P.H.S. STDS.).	Less than five (5) parts per billion.	None.	Not in sufficient quantities alone or in combination with other wastes to interfere with the use indicated.	Primary treatment and effective disinfection.
B. Water supply, drinking, culinary, and food processing: with treatment equal to coagulation, sedimentation, filtration, disinfection and any additional treatment necessary for removing naturally present impurities.	Same as for use "A" above.	Less than five (5) parts per billion.	None alone or in combination with other substances or wastes as to make receiving water unfit or unsafe for the use indicated.	Same as for use "A" above.	Primary treatment and effective disinfection.
C. Bathing, swimming and recreation Note: When waters are used for recreational purposes such as fishing & boating, exclusive of bathing & swimming, the number "1000" may be substituted for "240" in statement of coliform objective.	Same as for use "A" above.	Less than 25 parts per billion or none in sufficient amounts such as to impart a residual taste to recreational or commercial fish, shellfish, or other aquatic forms.	Same as for use "B" above.	Same as for use "A" above.	Primary treatment and effective disinfection.
D. Growth and propagation of fish, shellfish and other aquatic life.	None alone or in combination with other substances or wastes in sufficient amount or of such character as to make receiving waters unsafe or unsuitable for use indicated.	Same as for use "C" above.	Same as for use "B" above.	Not in sufficient quantity as to increase the temperature of the receiving water beyond that optimum for the normal aquatic life of the specific water.	Primary treatment for all uses under this group but disinfection required in addition only if discharged into waters used for the growth & propagation of shellfish, either commercial or recreational.
E. Agricultural and industrial water supply: without treatment except for the removal of natural impurities to meet special quality requirements, other than those classified under "A" above. Note: Permissible limits for total concentration percent sodium, boron, chlorides, and sulphates to receive further study. Suggested value for percent sodium is less than 40. Percent sodium means the ratio of sodium to total cations expressed in equivalent weights calculated from the formula $\frac{Na \times 100}{Na + K + Ca + Mg}$ when Na, Ca, and Mg are all expressed in equivalents.	Same as for use "A" above.	None in sufficient quantity as to make receiving water unsuitable for use indicated.	Same as for use "B" above.	Same as for use "A" above.	Primary treatment and effective disinfection.

Appendix II

MINIMUM REQUIREMENTS FOR PREVENTION OF INDUSTRIAL WASTE POLLUTION
Adopted by the Washington Pollution Control Commission

A. Slaughterhouses and Meat Packing Plants

All slaughterhouses and meat packing plants should provide the necessary facilities to conform to the following minimum requirements whether or not the plant is connected to a municipal sewer system:

1. Yards and holding pens shall be dry cleaned before washing down.
2. Kill blood shall be separately collected and the blood thoroughly squeegeed from the floor into the collection tank. The disposal, or utilization, of the blood thus collected will depend upon local facilities, but must be accomplished in a manner which conforms to sanitation regulations.
3. Paunch manure and hog stomach contents shall be collected separately and used as fertilizer, land-fill or in any other satisfactory manner. A fine screen is recommended wherever its installation is feasible.
4. Fleshings, grease particles and other solid material shall be collected by dry cleaning of floors and screening of wastes.
5. Adequate grease recovery basins shall be installed on drain lines from by-product processing rooms. These traps shall be skimmed and cleaned at least once each day. (Note: In the larger plants it is recommended that small basins be located wherever high grade greases can be recovered in significant quantity and that a main basin be installed on the main drain line. Wastes not containing grease should be by-passed around the basin.)

Plants should connect with the respective municipal sewer systems where feasible in order that the added treatment with municipal sewage will be provided. The two plants in Grandview are presently connected to the city system. For those connected or where a connection is not feasible, septic tanks and drain fields for domestic sewage and appropriate treatment facilities for washings and other process waste waters should be provided. Plans for these facilities should be submitted to the Pollution Control Commission prior to construction.

B. Vegetable, Fruit and Fruit Juice Canneries

All canneries should provide the necessary facilities to comply with the following minimum requirements whether or not the plant is connected to a municipal sewer system:

1. Vegetable and fruit canneries (unless other arrangements are made with this Commission) shall provide an efficient screen for the removal of skins, seeds, pomace, culls, discarded product and other suspended material from the wastes from the washing, sorting, or other canning processes. This screen should be at least 20-mesh, U. S. Standard gage, and may be of the vibrating, rotary or any other effective type. It shall be located on the main outlet sewer line or lines from the cannery in such a way that all waste waters will pass through the screen except cooling condenser or other clean waters. The latter may be by-passed around the screen or discharged through a separate outlet. Prior to the installation of the screen a plan drawing of the facility shall be submitted to the Pollution Control Commission for approval together with data as to capacity.
2. Screenings and other solid material removed from the product during the cannery operations shall be disposed of in a manner which will assure that it will not enter a State water.

Because large canneries have the effect of overloading municipal treatment plants, especially in small communities, efforts should be directed toward segregating these wastes from the municipal system and providing other means of disposal. Operations of these canneries are seasonal (from six weeks to three or four months) and in many cases the wastes can be disposed of by irrigation or lagooning.

All canneries and any new canneries should, in addition to adequate screening:

1. Segregate cooling and other clean waters for separate discharge to the waterways of the basin or to storm drains if such are available.
2. Provide for the recirculation of process waters within the cannery to reduce to a practical limit the quantity of waste discharged.
3. Provide for the lagooning of the waste and for use of the water for irrigation. The lagoons should be constructed according to the recommendations of the National Cannery Association (Bulletin No. 23).
4. In event conditions are such that lagooning or irrigation is not possible or practical, arrangements should be made for the further treatment of the screened waste through conferences with the staff of the Pollution Control Commission.

C. Milk and Milk Products Plants

All milk bottling plants and plants manufacturing milk products should provide the necessary equipment and facilities to conform to the following minimum requirements whether or not the plant drains are connected to a municipal sewer system:

1. Whole milk, skim milk, buttermilk, whey, condensed milk products, dried milk products or spoiled milk or milk products shall not be dumped or otherwise allowed to enter a drain line which leads, either directly or indirectly, to a State water.
2. Mechanical can washers, both straight-line or rotary, shall be equipped with a drip collector and the drip milk collected and disposed of in a manner which conforms to sanitation regulations.
3. Milk or milk products left in sanitary lines, tanks and equipment before washing shall be drained into suitable containers and disposed of in a satisfactory manner as directed above. It is recommended that these lines and equipment be installed to slope slightly to the point of collection.
4. Leaks in pumps, pipe lines and other equipment handling milk or milk products shall be repaired as rapidly as possible.
5. Accidental spillage shall be reduced to a minimum by providing appropriate alarms or automatic equipment to prevent such accidents and by proper instruction to personnel.

D. Wineries

All wineries should conform to the following minimum requirements as they apply to the specific industry:

1. Pomace which is a garbage-like material shall not be allowed to enter the liquid waste waters. If disposed of on land, the location of the disposal field shall be such that seepage water from the pile will not enter a surface water and that flood waters will not carry the material into public waters. Prevention of ground water contamination in the area must be also considered in the location of the field.
2. The major portion of the lees shall be separated and disposed of along with the pomace unless arrangements are made by agreement with this office and the respective municipal officials for disposal in a municipal sewage system

and treatment plant. If discharge to a municipal system is approved, the facilities to spread the discharge over a period of time, rather than in batches, must be provided.

3. Still slops shall not be disposed of in the sewer system. This waste product disposal is a locality problem and is subject to the same requirements given for pomace if land disposal is used.

Adequate screening facilities are usually necessary to accomplish the effective collection or recovery of the waste materials listed above. These screens should have an efficiency equivalent to the screening facilities recommended for canneries; namely, 20-mesh, U. S. Standard gage.

E. Breweries

Breweries of the Basin should comply with the following minimum requirements:

1. Under no conditions will brewer's grains be discharged to the sewer system. (Note: Grains have a definite market value and are almost always recovered and sold for cattle feed; however, provision must be made for holding or storage in case of breakdown or delay in transportation.)
2. Because of high concentration of the grain liquor, grain should be sold in a wet condition. In case the grain is dehydrated, special arrangements must be made for the disposal of the liquor by agreement with the Pollution Control Commission.
3. Spent hops shall be collected and disposed of as fertilizer, dumping on land, incineration or in some manner as to prevent this material from entering a State water.
4. Methods shall be devised for the separation and recovery of the yeast to prevent its entrance to the liquid waste drains.

F. Coal and Gravel Industries

Coal mining and gravel operations, where washing is practiced as a part of the operations, should provide effective ponds or other means for the removal of fine coal, coal dust, sand and silt, as the case may be. This material must be removed before the washings are discharged to any waterway of the Basin. Recirculation of washer water after settling should be used where practical. The detention periods in the ponds unless recirculation is employed should be established by conference with the Pollution Control Commission staff.

G. Beet Sugar Factories

Beet sugar factories should conform, at least, to the following minimum requirements:

1. An effective screen shall be provided for the factory and process wastes from the manufacture of beet sugar. The screenings will be removed and disposed of on land or in any other satisfactory manner. It is suggested that the slot openings of the screen be 1/8" x 3/4".
2. Steffens waste shall never be discharged to a State waterway. This waste must either be evaporated or ponded. In the latter case, it will be necessary to make arrangements with the Pollution Control Commission for the discharge of the ponded waste under controlled conditions, and during high-water periods.
3. Settling ponds shall be used for the removal of settleable material from factory and process waste. It is suggested that short-period ponds, constructed to operate in parallel, are more effective than large ponds operated in series. Certain of these ponds will be used until the material which settles starts to decompose. The waste will then be directed to other ponds.

H. Miscellaneous Uses of Oil

The following minimum requirements should be met by all users of oil:

1. Tankers, railroad tank cars, tank trucks or other facilities used for loading, unloading, and transportation of oil shall be equipped for the collection of the drip from hose or other connections and the excess oil contained in hose or pipe lines, wherever there is a possibility that this oil will find its way, either directly or indirectly, into a body of water. Provision shall be made also for catching accidental spills and these facilities shall be of such a capacity as to hold the maximum quantity of oil possible from any one spill.
2. Roundhouses shall be provided with facilities for the collection of all oil and oil-and-water mixtures and an adequate separator shall be installed for the separation and recovery of both light and heavy oils from these mixtures. These separators shall be operated in such a manner as to assure their maximum efficiency.
3. Wherever practical, all waste oils and lubricants from industrial operations should be collected in containers for proper disposal. Oil emulsions used for machine cutting and tool cutting should be collected, treated and reused wherever possible. In event these emulsions are discarded, the emulsion must be broken down and the oil recovered for proper disposal. The general wastes from processes, if they contain oil, must first be passed through an adequate and well-operated oil separator before being discharged into the waters of the State.
4. Service stations with direct outlets to a body of water shall not discard oil to that water or so dispose of it in such a manner that it will be washed into the waters by run-off.
5. Officials of cities, towns and sewer districts are directly responsible for the control of oil discharged from their respective sewerage systems. It is strongly urged that ordinances be passed which will make it unlawful to dump or otherwise discharge oil into these sewer systems.
6. Since it is usually desirable to dispose of waste or recovered oil by burning, this should be accomplished with due regard to local or other regulations and without the production of nuisances or hazards. The location of disposal points shall be such as to eliminate any possible pollution of either surface or underground waters.

I. Logging Industry

All logging operations, especially in the upper reaches of the various tributaries, should be conducted in such a manner as to minimize the effects of these operations on the uses of these waters. Attention should be given to such items as the location, and construction of logging roads, the disposal of slashings and other refuse, burning-over of areas, and other factors which increase the rate of run-off, cause erosion, and the silting of the streams. The waterways should be kept free of barriers to the movement of fish. Special attention should be given to control of logging operations in watersheds from which domestic and industrial supplies are or may be taken.

J. Agriculture Industry

Irrigation practices should be controlled to minimize erosion and the loss of soil to ditches and streams.

K. New Industries

Waste disposal should be considered as one of the major factors in the location of new industries. Those considering the establishment or development of new industries where the disposal of a liquid waste is involved should contact the Pollution Control Commission prior to the final planning stage.